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# THE BOTANY OF THE CUYAMACA MOUNTAINS.

BY J. G. COOPER, M.D.

DURING the last week of April, 1872, I made a rapid but very delightful trip through a region scarcely known to naturalists, and of which the very name, as given above, is not, I believe, to be found on any published map.

Yet it is a range equal in extent and height to the White Mountains of New England, that favorite resort of eastern naturalists, which has furnished them with so many interesting subarctic species both of animals and plants.

The highest ridge of the Cuyamaca range lies forty miles east of San Diego Bay, being at the southwest corner of the Union, and thus almost the antipodes of the White Mountains: with which, however, we may compare it in many respects.* The summits of the three highest peaks are thus nearly as far from the coast as Mount Washington, and the central one, measured by my companion, Mr. W. A. Goodyear of the California Geological Survey, was found to be also about six thousand two hundred feet above the sea by mercurial barometer. The great mass of the range is granite, with some mica and talcose slate on its flanks, especially the eastern, where there are also gold mines, not long opened, but already paying well.

The foot-hills of the range commence about ten miles from the coast, some of them at once rising into rugged hills over one thousand feet high, and very conspicuous from contrast with the nearly level table-land (or "Mésa" of the Spanish-Americans), which extends from the sea inland, and often among the bases of the hills up to eight hundred feet elevation. This mésa is of very recent geological age, and has been lifted by successive stages so that it presents the appearance of more or less continuous terraces, at various intervals inland.

On the east side the descent is exceedingly rapid, from an elevation of four hundred feet a few miles east of the highest peaks, down to the Colorado Desert, which has lately been found by the railroad surveyors to be actually over two hundred feet below the level of the sea in its central parts. Looking off from the mountains in that direction, we see an immense, sandy level plain, bounded by distant rugged mountains toward the northeast, but illimitable toward the southeast, except by the dim misty horizon. Not a tree nor a trace of green vegetation relieves the eye, and we gladly turn away from it to the verdant hills above the summit of the wall from which we have been looking eastward.

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* The present article will show that on account of the scarcity of that one essential element, water, the southwestern range produces much fewer species than the northeastern.

The base of the range is therefore about fifty-five miles wide, with a slope of five thousand four hundred feet in thirty miles toward the west, and of the same amount in only fifteen miles on the east. It is singular that all the water falling *east* of the high peaks finds its way around them and runs to the *west*.

VEGETATION. — Being thus the western rim of the desert, the dryest portion of the United States, where the rainfall (as measured at Fort Yuma) averages only about *two inches* annually, we may expect the mountains to partake, in some degree, of the sterility of the desert itself. But their vicinity to the Pacific Ocean, that exhaustless reservoir from which most of the rains of the western slope are derived, produces a fair amount of rainfall in winter, and at the same time increases the dryness of the desert, by intercepting this precipitation. At the same time the *summer* rains of Mexico and Arizona are to some extent poured out upon the eastern slope of the mountains between four thousand and six thousand feet elevation, thus failing to reach the coast, though they can be seen frequently from San Diego falling as thunder-storms upon the mountain tops, and very rarely pass over the lower passes northward to the Los Angeles plains.

Consequently the highest ridge is thickly clothed with trees, and although they end at four thousand feet on the east slope, they extend down the western, gradually thinning out, to the edges of the mésa, and thence along the banks of the rivers nearly to the sea. The lower mountains, and parts of the mésa are covered with shrubs but scarcely dense enough to hide the sterile rocks and gravel.

Near the sea, herbage of various kinds, but thin and of little value as pasture, covers the surface; improving, however, where ploughing has loosened the soil, packed almost to the hardness of bricks by two centuries of cattle-grazing and by the arid climate. A narrow belt of shrubby oaks (Adenostema and

Spiræa with some other shrubs), runs along within a mile of the beach, watered and sustained by the sea-fogs. Then comes what may be called the cactus zone, as six or eight species of that family, with low yuccas and other plants of the group bordering the desert are the most striking growth, often forming thickets by themselves in sandy places, and being in the dry season almost the only green vegetation. The laurel sumach ( *Lithræa laurina* Nutt.) is a shrubby tree accompanying them in thickets of small extent.

These characterize the mésa, scarcely ascending above it, and form indeed the northern extension of the flora of the still more arid peninsula. The river-bottoms are more fertile, many grasses, flowering plants and small live-oaks (*Quercus agrifolia* Nees), sycamores and willows, lining the edges of the water-courses, which are, however, usually dry during nine months of the year, for a distance of five or six miles above their mouths. This valley vegetation consists chiefly of plants more common on the moist mountains, and in a great degree of species belonging to the northern instead of the southern (or lower) Californian flora. Some of the sandy portions, however, reproduce nearly the same group as the Colorado valley. Of course it is quite possible that isolated specimens of some trees may exist, not met with on our journey.

As the botanists of the Mexican Boundary, and Pacific R. R. Surveys have explored and thoroughly analyzed the flora of these lower zones, I will refer to their reports for further details.

The forests of the mountains may perhaps be best illustrated by giving an abstract of my observations made during our brief journey across them, at the same time giving an idea of the climate at the end of April.*

April 26th. At 1 P. M., we left town and rode over the mésa to the San Diego river, encamping a mile above the old Mission, where date palms and olives in cultivation give quite a tropical aspect to the already parched and barren scene. A few pools of stagnant water only remain in the wide sandy river-bed. I walked from camp three miles over the mésa north of the valley, to where it abuts against the granite hill through which the river has cut a deep narrow cañon, returning for two miles through the lower part of this cañon. A little rivulet still runs down here, but sinks before reaching camp, and we had to obtain water from a well. Oak and sycamore (*Platanus racemosa* Nutt.) are here quite luxuriant close to the water but disappear below camp, and even willows become very small.* Remains of the ancient aqueduct, built by the Spanish missionaries full seventy years ago, to carry water from above this cañon nine miles to the mission, are very conspicuous, and show much engineering skill, as well as excellent workmanship.

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* In the tables of tree distribution in the Smithsonian Report, for 1858, I gave "San Diego Mountains" as the southwest range of many species not found there by me, having been wrongly informed as to their locality.

April 27th. Mr. Goodyear and Mr. Fox of the Southern Pacific R. R., walked up the cañon to examine the geology and the aqueduct, finding an excellent dam, which has withstood nearly a century of summer droughts and winter torrents. I rode up the south mésa nine miles to Cajon valley, a basin lying between the mésa and the hills, in part the remnant of an old lake-bed excavated by the river before it broke through the hills. It now however looks very arid, the granitic gravel covering it being only thinly concealed by crops of wheat just ripening, and the surrounding native vegetation being all dried up. A few small elder trees (*Sambucus glauca*) are the only green things visible about a spring on the south side of the valley.

The river runs on the north side, six miles distant, and is there pretty well lined with the trees mentioned, together with some large cotton-wood poplars (*P. monilifera*). Its elevation being four hundred feet above the sea, and the impervious granite retaining the moisture, we find a great increase in tree growth compared with the lower region, but still confined to the moist river banks. The greater moisture is still further shown by the fact that although so arid, this is the first valley where a crop is successful this year, though it will mostly be cut for hay, which is so high priced at San Diego as to make it more profitable to cut it than to wait for the uncertain and light crop of wheat. Some other grain and vegetables are also raised along the river. The California wild grape (*Vitis Californica* Benth.) grows in moist spots about this valley. The green cornel (*Cornus pubescens* Nutt.) also forms a small tree along the streams.

About six miles east, the river again forms a cañon in which it never dries up and where the Indians have their favorite settlement, convenient to the acorn crop. The road, however, leaves this cañon on the north, ascending over rolling granitic hills, on which, at about six hundred feet altitude, we meet the first thick-cup oak (*Quercus crassipocula*), a curious form, with pale oval leaves, sometimes lobate, which remain green all winter down here, and fall on the coming out of the new leaves, now just grown. Various mountain plants, before unseen, accompany it, and it is perhaps the limit of the orange, which has been growing here for more than ten years successfully on Ames' ranche. The most notable shrubby trees are the northern evergreen plum (*Prunus ilicifolia* Nutt.), "wild lilac" (*Ceanothus thyrsiflorus* Esch.), and a shrubby live oak (*Q. Ransomi* Kell.).

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* Two or three species in these mountains grow sixty feet high and two in diameter, but I cannot name them.

Five miles from the valley at Flynn's, about nine hundred feet elevation, and in a narrow ravine, we first found a really luxuriant vegetation; the trees very large, crops heavy and a fine orchard, eight years old, of all the common fruits and some young orange-trees, figs, grapes, etc. The chief cause of this productiveness was forcibly impressed on our mind, by finding that the usual sea-fogs, which had been more dense than usual this day in the form of a cloudy sky, began to condense into rain after sunset, and heavy showers continued during the whole night. We afterwards learned that this rain was light in Cajon valley, but did not reach San Diego at all, though general in the northern part of the state.

April 28th. Light showers continued until 10 A. M., and as the clouds lifted, we saw the Cuyamaca Mountains, white with snow, only a few miles east of us. Crossing rocky and mostly barren granitic hills, which become more and more covered on their north slopes with large shrubs of northern species of Ceanothus, Arctostaphylus, etc., we reached another old lake bed called "Valle de los Viejos" (from some ancient aborigines found there by the first Mexican visitors), having an elevation of over two thousand feet, and where the verdure of spring was scarcely beginning to wither, but showed a paucity of species indicating that it is too cool for the southern desert forms and too dry at times for many of the northern.

From this we ascended a steep rocky ridge one thousand five hundred feet more, from the top of which we could look down on San Diego Bay, and distinguish the lighthouse plainly, to the southwest. Shrubs only cover this slope, but on crossing the summit, we immediately enter a scattered but luxuriant forest of live oak (*Q. agrifolia*). The scene reminded me strongly of the similar growth on the mountains near Santa Cruz two hundred and eighty miles farther north, near the sea-level. Crossing a wide valley with a fine running stream, we ascended again and encamped at a height of three thousand eight hundred feet, about two hundred feet below the commencement of the pine growth. The two evergreen oaks here grow splendidly, scattered among grassy meadows fit only for grazing, on account of early frosts.

April 29th. There was heavy frost in the night forming thin ice at camp. Still gradually ascending through a lovely forest, alive with the songs of migrating spring birds, we found the yellow pine (*P. ponderosa* Dougl.) at a height of about four thousand feet, and a little higher the black oak (*Quercus Sonomensis*) just leafing out, a most beautiful reminder of the northern deciduous forests. Then comes the lofty and magnificent sugar pine (*P. Lambertiana* Dougl.), and near the summit of the dividing ridge, the graceful "white cedar" (*Libocedrus decurrens* Torr.), and a spruce which seemed, from the remnants of cones, to be the noble fir (*Picea nobilis* Dougl.); at about five thousand feet elevation, forming a tree three feet in diameter.

We have thus above the cactus zone, a zone of oaks from six hundred to four thousand feet, and then a zone of pines from four thousand to six thousand two hundred feet, but the former encroaches widely on the latter.

The road crosses this summit by an easy grade, close to the base of the highest peak, and a dense forest covers this and the other two next highest, which lie north and south of it. Circumstances prevented me from ascending the summit, very much to my regret, but I was informed by the gentlemen who did so, that the sugar pine and fir form the chief growth, with some oaks and Libocedrus and a less common pine with lower growth and spreading branches, but very large cones, apparently the *P. Sabiniana* Douglas, of the lower Sierra.

Frozen snow covered the branches of these trees for five hundred feet below the summit, making it dangerous for the travellers, from the chance of heavily encrusted branches or cones falling on them, but they made the trip safely, there being no wind, and the sun coming out so warmly, as soon to clear away the icy coating. The alder (*Alnus oblongifolius* Torr.) and sycamore continue up to five thousand feet on the west side of this ridge, but disappear on the eastern. Descending about five hundred feet to the Stonewall mine, the country is varied with grassy meadows and hills covered with yellow pine and thick-cup oak, which here nearly altogether replaces the *Q. agrifolia*. It is also less forward in leafing than on the west slope where first seen, the old leaves almost all remaining. A low ridge east of this, and forming the summit of the steep descent to the desert, produces a scattered growth of the *P. Sabiniana* almost alone, just as it grows on the foot-hills bordering both sides of the San Joaquin valley, etc.

Among the herbaceous plants I recognized most as familiar northern species, and saw indications in their forms of a more arid climate than on the west slope at the same elevation. Our rapid journey and want of materials prevented me from obtaining a series of them, which would be interesting if only for the purposes of geographical botany.

April 30th. The road now going northward led us over the east base of the most northern peak, where I was much surprised at passing through one of the densest forests I have seen in California, for a distance of about five miles, consisting of the two live oaks and sugar pine, the former sometimes five to seven feet in diameter. The variety of *Q. agrifolia*, called *Q. oxyadera* by Torrey, is quite numerous from two thousand to four thousand feet altitude. What made it most surprising was that a few rods from its sharply defined eastern edge, is the rocky barren ridge forming the rim of the desert, and it seemed unaccountable how such a dense growth of trees could exist there. I was informed, however, by Mr. Fox that the "Sonora rains," as they are called here, are very frequent on this slope during summer, supplying the requisite moisture. He also told us that Pine valley, about fifteen miles southward, is the limit of pines in that direction, the mountains becoming so low near these as to intercept little moisture and to be consequently very arid. Such is their character along the line selected for the Southern Pacific R. R., and as far as can be seen in lower California.

The thick woods do not descend below about four thousand five hundred feet, where we came to a rolling hilly country, grassy and with scattered trees, chiefly on north slopes, of the oaks, yellow pine and *P. Sabiniana*, — extending to San Felipe Pass, at the summit of which are the most productive gold mines, and the rising village known as Julian City, four thousand feet elevation. The situation is beautiful at this season, but the whole of this slope is too subject to the parching east or "Desert" winds to be of much value for any but mining purposes. From here the descent toward the northwest is very rapid, and pines end all at once; oaks, however, continuing on the north slopes and in moist spots. The *Quercus agrifolia* becomes again more common than the *Quercus crassipocula* which ceases at about six hundred feet. On the east slope it will be noticed that the zone of oaks is entirely wanting, or is mingled with that of pines, while the cactus zone immediately succeeds them.

Here the Cuyamaca range ends, being separated from other ranges to the north and northeast by the Pass and by Santa Isabel valley at the head of San Bernardo river. Its length, from this to the railroad pass near the Mexican Boundary, is thus about twenty-five miles, its width about the same, leaving out the low foot-hills on the west, and including only the portion above an elevation of two thousand feet. Descending into the valley, the sycamore reappears at about three thousand eight hundred feet, the cottonwood at three thousand five hundred feet, and the black oak disappears at the same elevation. The country is more cut up by wide valleys than on the slope we ascended, but they are generally drier at the same altitude. At our camp in a narrow valley, one thousand eight hundred and fifty feet high, trees were scarce, and crops grew only by irrigation.

May 1st. The road led over a rolling granitic ridge of hills between the San Bernardo and San Diego rivers, with scanty herbage and scattered oak groves, to the north side of Cajon valley, where we looked down from about one thousand feet elevation over this curious basin six hundred feet below us, and also over the terraced mésa toward the ocean, plainly perceiving San Clemente island eighty-five miles distant. The "Desert wind," which commenced yesterday, made the air unusually clear, but at the same time was so hot and dry as to be very uncomfortable. The Cuyamaca peaks appeared now to be completely bare of snow.

As the rest of the journey back was over the same route before described, I omit farther extracts from my journal. It must appear from these notes that this range, from its liability to severe droughts, does not have such a luxuriant flora and sylva as might be expected from its southern position, the trees being all merely stragglers from more northern forests, and none of them, except the yellow pine and oaks, found in great abundance. At the same time the altitude of the central peaks, and the consequent coldness around their bases (snow falling on them as late as the middle of May some years), prevent the growth of the more southern group of trees and plants, which might find the moisture sufficient, above one thousand feet.

This is shown by the fact that in two isolated localities not far from this range, but in the low country, are small groves of trees probably belonging properly to the Sylva of the warmer high mountains of lower California. One of these is *Pinus Torreyana*, growing scantily on the sandstone bluffs near the mouth of Soledad creek, nine miles north of S. Diego Bay, and three hundred and fifty feet above the sea. The other is *Quercus oblongifolia*, found near the head of San Luis Rey river, sixteen miles north of Santa Isabel valley, and about one hundred and fifty feet altitude.* Besides these we miss on this range many northern trees found on the San Bernardino Range (eleven thousand six hundred feet high, by Mr. Goodyear's measurement). Of these I have noted the far-spread red fir (*Tsuga Douglasii*) and walnut (*Juglans rupestris* Englm.). The nut pine (*P. monophyllus* Torr.), and juniper (*J. occidentalis* Nutt.), of the great arid basin east of the mountains, very probably grow scantily lower down the eastern slope of this range.

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# SCIENCE IN THE UNITED STATES.

## FROM THE FRENCH OF ALPHONSE DE CANDOLLE.

[THE following extract is taken from a recent publication, entitled "Histoire des Sciences et des Savants depuis deux siècles" — a very curious and instructive work, in which the lists of foreign associates and correspondents of the three leading scientific academies (those of Paris, London and Berlin) have been scrutinized with elaborate care and subjected to a most searching analysis. The passage which we have translated is a section upon the United States, contained in a detailed "examination of different countries viewed with regard to the causes of their influence on the sciences." It is difficult fully to appreciate the

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* I am inclined to believe this to be only a very luxuriant growth of *Q. crassipocula*, but have not seen the acorns.